IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

LINDQVIST et al. Atty. Ref.: 1410-679; Confirmation No.

Appl. No. 09/584,796 TC/A.U. 2643

Filed: June 1, 2000 Examiner: Jamal, Alexander

For: A FREQUENCY DOMAIN ECHO CANCELLER

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January 12, 2007

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

REPLY BRIEF

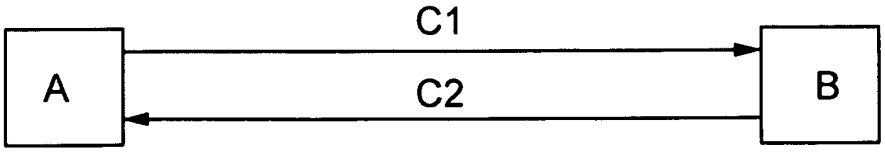
This reply brief addresses new issues raised in the Examiner's Answer.

On page 10, the Examiner is unclear about the statement made regarding previously transmitted symbols and Ho's echo canceller. The Examiner alleges that "Ho functions to remove any echoes (caused by previous symbols). Appellants disagree. In Ho, part of the echo is removed in the time domain, and part is removed in frequency-domain. In contrast, in claims 1 and 12, the echo is modeled and removed in the frequency domain. The reason Ho takes this approach is that Ho does not (and can not) remove the echo due to a previous symbol *in the frequency domain.*

The Examiner elects at the bottom of page 15 of the Answer not to address the specific problems outlined in the Brief with trying to combine Ho or Chaffee with Dowling. Indeed, the

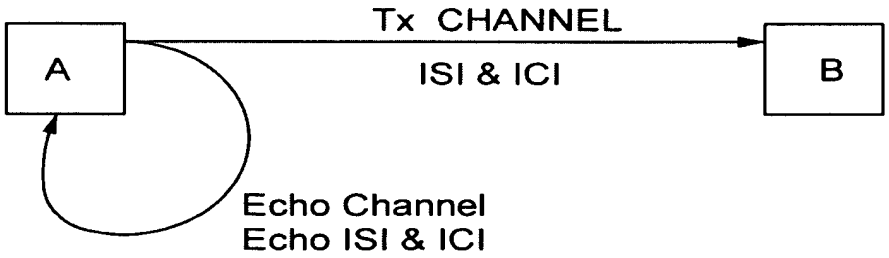
Examiner suggests that it is Appellants' burden "to offer an explanation as to how the precoder and echo canceller would be merged (as per the disclosed prior art) and not function as per appellant's claim language." See page 12 of the Answer. But it is well established that the burden of making a prima facie case is on the Examiner—not on Appellants. *In re Piasecki*, 223 USPQ 785, 788 (Fed. Cir. 1985) ("As adapted to ex parte procedure, *Graham* is interpreted as continuing to place the 'burden of proof on the Patent Office which requires it to produce the factual basis for its rejection of an application under sections 102 and 103.'") That burden has not been met because one of ordinary skill in the art would not have made the proposed Ho/Chaffee/Dowling combinations for at least the reasons explained in the Appeal Brief on pages 12-14.

The Board should appreciate that Dowling's approach is to predistort the signal before it is transmitted in the hope that the signal received arrives without distortion. An echo canceler uses a completely different approach where the echo is estimated and removed from the received signal. But even if the proposed combinations could be made, they still do not model ISI and/or ICI of the ***echo*** channel as claimed. The fundamental assumption the Examiner is making in the Answer is that the transmission channel from the near end transceiver A to the far end transceiver B is the same as the echo channel from the transmitter in transceiver A back to the receiver in transceiver A. This assumption is false. Two simple examples help explain this point. The first is illustrated below.



The near end transceiver A transmits a complex signal over channel C1 (every channel has its own frequency response or transfer function) to far end transceiver B. A complex signal includes real and imaginary components which are commonly represented as a magnitude and a phase. Transceiver B transmits a complex signal over channel C2 to transceiver A. Assume for this example that C1 and C2 correspond to the same physical wire. Even so, the transfer function corresponding to channel C1 is not the same as the transfer function for channel C2. Although it might be the case that the attenuation experienced by the complex signal transmitted over channel C1 is similar to the attenuation experienced by the complex signal transmitted over C2, the phase change experienced by the complex signal transmitted over C1 is not the same as the phase change experienced by a signal transmitted over C2. Accordingly, channel C1 is not the same as channel C2, and any ISI or ICI on C1 is not the same as ISI or ICI on C2.

The second example below illustrates these points for a transmission channel C1 between transceivers A and B and an echo channel between the transmitter and the receiver in transceiver A.



ISI and ICI may be viewed as a disturbance caused by the channel. A channel's ISI and ICI can be expressed in terms of the channel's frequency response, or equivalently, the channel's impulse response. Thus, two different channels will give rise to *different* ISI and ICI contributions to the received signal.

In the claims on appeal, the ISI and ICI are modeled by matrices and/or vectors whose elements depend on the frequency response (or equivalently the impulse response) of the *echo* channel. The ISI and ICI that the echo canceller models, estimates, and removes are echo ISI and echo ICI—not the transmission channel ISI or the transmission channel ICI which are *different* from the ISI or ICI on the *echo* channel.

The Examiner provides no evidence to corroborate his erroneous assumption other than to point to page 3, lines 18-21 of Appellants' specification. In that background portion of the specification, the general concept of channels experiencing ISI and ICI is introduced. The point made in lines 18-21 is simply that an echo channel also experiences ISI and ICI. Although the transmission channel ISI and ICI affect the ISI and ICI on the echo channel, one skilled in echo cancellation would understand that the ISI and ICI on that transmission channel are not identical to the ISI and ICI on the echo channel. So compensating the signal to be transmitted using an inverse of the transmission channel model including transmission channel ISI does not cancel the echo channel ISI or ICI.

The Examiner also refers to page 4, lines 17-18 of Appellants' specification. But a that text is simply describing a feature of several of the claims on appeal. It is not seen how that is relevant to the Examiner's argument.

The Examiner states that "an echo path estimate based off an ISI/ICI resistant precoded signal will be based off the transmission channel used in precoding the transmit signal." See page 14. This argument is incorrect because the transfer functions of transmission channel and echo channel are different, and the ISI and ICI present on the transmission channel are different from that present on the echo channel. So assuming that Dowling's precoder is implemented in Ho's encoder 12, all that would do is to precode the signal to be transmitted. The precoder

models the inverse of the transmission channel in an attempt to pre-equilize or pre-compensate the transmitted signal for the distortion effects of the *transmission* channel—not the *echo* channel.

The precoded signal output by the encoder 12 is then input to Ho's echo canceller 100—none of the precoding has anything to do with estimating, modeling, compensating for, reducing, or canceling echo. That is why Dowling admits in column 22, lines 1-3 that an echo canceller is still needed if one wants to cancel echo. Dowling does not disclose or suggest that such an echo canceler precode the transmitted signal to compensate for the echo channel. Dowling simply envisions using some sort of traditional echo canceller.

From the pre-coded signal generated by Ho's modified encoder 12, Ho's echo canceller 100 determines and cancels echo in the time domain e(n) and echo in the frequency domain E(f). The Examiner has already admitted that Ho and Chaffee do not estimate or model the echo as recited in the independent claims. Claim 1, as an example, recites: "wherein the first electronic circuitry is further configured to estimate the echo signals in the frequency domain using a combination of (i) a product of a first matrix of coefficients in the frequency domain and a transmitted symbol and (ii) a product of a second matrix of coefficients in the frequency domain and a previously-transmitted symbol." That first electronic circuitry is not disclosed or suggested in Ho or Chaffee.

Ho's echo canceller 100 would process the pre-coded input signals X(f) and x(n) in the proposed combination in the same way as it processes the normal encoded output from encoder 12. In neither case are the transmission characteristics of the *echo* channel modeled or estimated as claimed. The fact that the input signal might be precoded/predistorted to compensate for the *transmission* channel distortion does not mean that such precoding/predistorting also

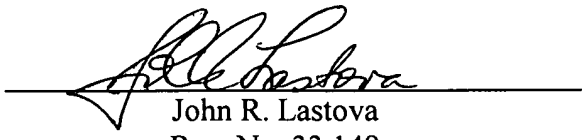
compensates for distortion on the *echo* channel. It is simply the input signal that the echo canceller 100 works with. Compensating for ISI on the transmission channel does not mean that the echo channel ICI and/or ISI are compensated for.

The Examiner argues that Dowlings's compensation for ISI on the *transmission* channel meets the limitations in claims 20 and 30 relating to ICI. The question is not whether compensating for ISI may reduce some ICI. Claim 20 requires "canceling an echo from a received signal in the frequency domain including circuitry configured to *determine an estimate of the echo in the received signal using a frequency domain model of an echo path channel that takes into account effects of inter-carrier interference*." Claim 30 recites a "circuitry configured to determine an estimate of the echo in the received signal using *a frequency domain model of an echo path channel that includes effects of intersymbol interference and inter-carrier interference*." There is no teaching of a frequency domain model of echo path channel inter-carrier interference (ICI) in Dowling.

As explained here and in the Appeal Brief, features of the independent claims are not disclosed or suggested by the combination of Ho and Dowling or Chaffee and Dowling. Nor is there proper motivation to combine their teachings as the Examiner proposes. The Board should reverse the outstanding rejections.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 
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